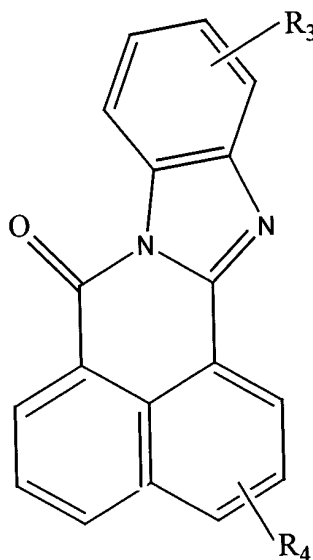


We Claim:

1. A fluorescent monomer selected from the group consisting of compounds of the formulae:



(Purple)

5

wherein R_3 is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy

or vinylbenzyloxy; and

R_4 is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy;

with the proviso that when one of R_3 or R_4 is sulfonic acid and its salts or carboxylic acid and its

10 salts, the other must be allyloxy or vinylbenzyloxy.

2. A fluorescent monomer of Claim 1, which is Monomer (Purple), wherein said monomer is named:

5-allyloxy-4'-carboxyl-1,8-naphtho[2,1-b]benzimidazole.

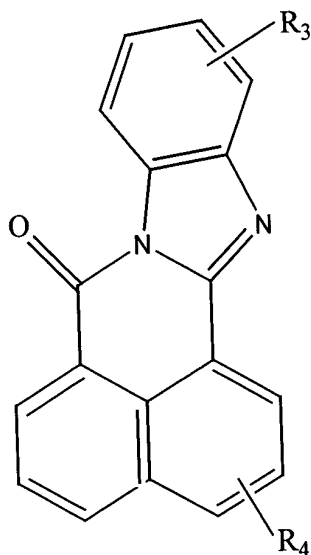
3. A fluorescent monomer of Claim 1 which is

15 6-vinylbenzyloxy-4'-carboxy-1,8-naphtho[2,1-b]benzimidazole.

4. A tagged treatment polymer selected from the group consisting of:

(1) $G_a Q_j W_t$

wherein G is selected from the group consisting of:



(Purple)

wherein R_3 is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; and

R_4 is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy;

with the proviso that when one of R_3 or R_4 is sulfonic acid and its salts or carboxylic acid and its

salts, the other must be allyloxy or vinylbenzyloxy:

wherein Q is selected from the group consisting of acrylic acid and

salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, ,

acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

wherein W is selected from the group consisting of:

acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof,

maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide,

methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide,
 N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide,
 N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts,
 dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate
 5 methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt,
 dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl
 acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate
 quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl
 methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts),
 10 dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl
 methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium
 chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide,
 triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate,
 hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol
 15 dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl
 methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol,
 vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

20 wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W

cannot both be the same;

5 wherein S is selected from the group consisting of sulfomethylacrylamide and
sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

10 wherein c is from about 1 to about 40 mole percent; and

wherein $a + v + f + c = 100$.

5. A tagged treatment polymer of Claim 4 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole.

6. A tagged treatment polymer of Claim 4 wherein G is
15 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole.

7. A tagged treatment polymer of Claim 4 wherein Q is
acrylic acid and W is acrylamide.

8. A tagged treatment polymer of Claim 4 wherein Q is
acrylamide, W is acrylic acid and S is N-sulfomethylacrylamide.

20 9. A tagged treatment polymer of Claim 4 wherein Q is
acrylic acid and W is acrylamidomethylpropane sulfonic acid.

10. A tagged treatment polymer of Claim 4 wherein G is

5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.

11. A tagged treatment polymer of Claim 4 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.

12. A tagged treatment polymer of claim 4 wherein G is 5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.

13. A tagged treatment polymer of claim 4 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.

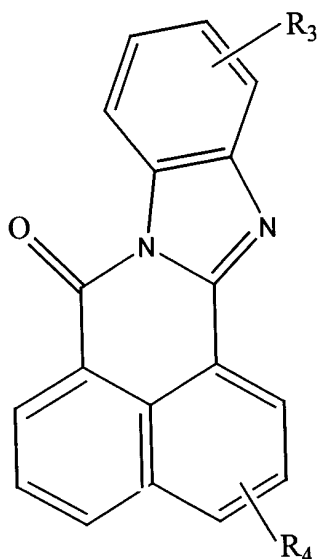
14. A tagged treatment polymer of Claim 4 wherein G is 5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole and Q is acrylic acid.

15. A tagged treatment polymer of claim 4 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole and Q is acrylic acid.

16. A process for the inhibition of scale formation in an industrial water system which comprises introducing into said industrial water system a tagged treatment polymer selected from the group consisting of:

(1) $G_a Q_j W_t$

wherein G is selected from the group consisting of:



(Purple)

5 wherein R₃ is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; and

R₄ is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; with the proviso that when one of R₃ or R₄ is sulfonic acid and its salts or carboxylic acid and its salts, the other must be allyloxy or vinylbenzyloxy.

10 wherein Q is selected from the group consisting of acrylic acid and salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, , acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

 wherein W is selected from the group consisting of:

acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof,

15 maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide,

methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide,

N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide,
 N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts,
 dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate
 methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt,
 5 dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl
 acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate
 quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl
 methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts),
 dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl
 10 methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium
 chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide,
 triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate,
 hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol
 dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl
 15 methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol,
 vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

20 wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W

cannot both be the same;

5 wherein S is selected from the group consisting of sulfomethylacrylamide and sulfoethylacrylamide;

 wherein a is from about 0.001 to about 10.00 mole percent;

 wherein v is from about 0 to about 97.999 mole percent;

 wherein f is from about 1 to about 97.999 mole percent;

10 wherein c is from about 1 to about 40 mole percent; and

 wherein $a + v + f + c = 100$;

in an amount sufficient to inhibit scale formation.

17. The process of Claim 16 wherein Q is acrylic acid and W is acrylamide.

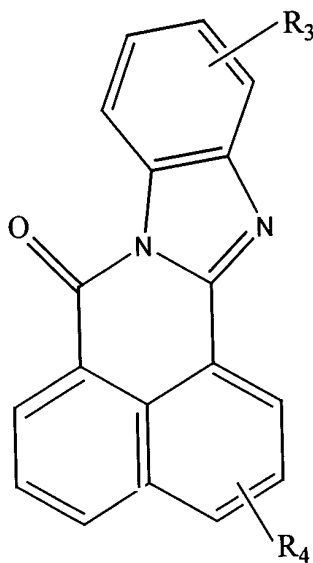
18. The process of Claim 16 wherein Q is acrylamide, W is acrylic acid and S is
15 N-sulfomethyl acrylamide.

19. The process of Claim 16 wherein Q is acrylic acid and W is
acrylamidomethylpropane sulfonic acid.

20. The process of Claim 16 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid, W is
20 acrylamide and S is N-sulfomethylacrylamide.

21. The process of Claim 16 wherein G is
6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole, Q is acrylic acid, W
is acrylamide and S is N-sulfomethylacrylamide.

22. The process of Claim 16 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid and W is
acrylamidomethylpropane sulfonic acid.
23. The process of Claim 16 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-
5 1',2'-benzimidazole, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
24. The process of Claim 16 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole and Q is acrylic acid.
25. The process of Claim 16 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-
1',2'-benzimidazole and Q is acrylic acid.
- 10 26. A method for maintaining the desired amount of tagged treatment polymer in
an industrial water system comprising the steps of:
- i) adding to said industrial water system a tagged treatment polymer,
selected from a group consisting of:
- (1) $G_a Q_j W_t$
- 15 wherein G is selected from the group consisting of:



(Purple)

wherein R₃ is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; and

R₄ is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; with the proviso that when one of R₃ or R₄ is sulfonic acid and its salts or carboxylic acid and its salts, the other must be allyloxy or vinylbenzyloxy;

wherein Q is selected from the group consisting of acrylic acid and salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, , acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

wherein W is selected from the group consisting of:

acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide, methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide,

N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts,

dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt, dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts), dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide, triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate, hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol, vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W

cannot both be the same;

wherein S is selected from the group consisting of sulfomethylacrylamide and sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

5 wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

wherein c is from about 1 to about 40 mole percent; and

wherein $a + v + f + c = 100$;

- 10 ii) using a fluorometer to detect the fluorescent signal of said tagged treatment polymer;
- iii) converting the fluorescent signal of said tagged treatment polymer to the concentration of said tagged treatment polymer; and
- iv) adjusting the concentration of said tagged treatment polymer according to what the desired concentration is for said tagged treatment polymer in said
- 15 industrial water system.

27. The method of Claim 26 wherein Q is acrylic acid and W is acrylamide.

28. The method of Claim 26 wherein Q is acrylamide, W is acrylic acid and S is N-sulfomethylacrylamide.

29. The method of Claim 26 wherein Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.

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30. The method of Claim 26 wherein G is 5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid, W is acrylamide and S is N-sulfomethylacrylamide.

31. The method of Claim 26 wherein G is
6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole, Q is acrylic acid, W
is acrylamide and S is N-sulfomethylacrylamide.

32. The method of Claim 26 wherein said fluorescent monomer G is
5 5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid and W is
acrylamidomethylpropane sulfonic acid.

33. The method of Claim 26 wherein said fluorescent monomer G is
6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole, Q is acrylic acid and
W is acrylamidomethylpropane sulfonic acid.

10 34. The method of Claim 26 wherein said fluorescent monomer G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole and Q is acrylic acid.

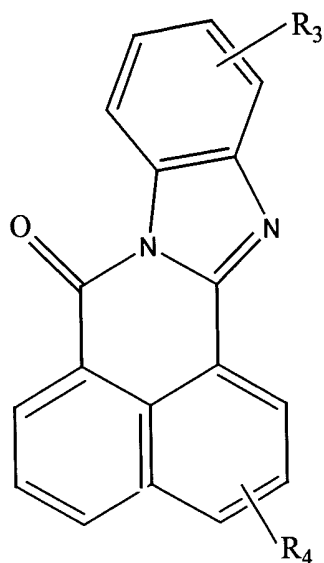
35. The method of Claim 26 wherein said fluorescent monomer G is
6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole and Q is acrylic acid.

15 36. A method for maintaining the desired amount of tagged treatment polymer in
an industrial water system comprising the steps of:

a) adding an inert tracer and a tagged treatment polymer to the water of an
industrial water system, wherein said tagged treatment polymer is selected from the
group consisting of:

(1) $G_aQ_jW_t$

20 wherein G is selected from the group consisting of:



(Purple)

wherein R₃ is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; and

5 R₄ is sulfonic acid and its salts or carboxylic acid and its salts or allyloxy or vinylbenzyloxy; with the proviso that when one of R₃ or R₄ is sulfonic acid and its salts or carboxylic acid and its salts, the other must be allyloxy or vinylbenzyloxy.

wherein Q is selected from the group consisting of acrylic acid and salts thereof, methacrylic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, ,
10 acrylamide, crotonic acid, acrylamidomethylpropane sulfonic acid and salts thereof;

wherein W is selected from the group consisting of:

acrylic acid and salts thereof, methacrylic acid and salts thereof, itaconic acid and salts thereof, maleic acid and salts thereof, maleic anhydride, crotonic acid and salts thereof, acrylamide, methacrylamide, vinyl sulfonic acid, styrene sulfonate, N-tertbutylacrylamide,
15 N-isopropylacrylamide, butoxymethylacrylamide, N,N-dimethylacrylamide, N,N-diethylacrylamide, dimethylaminoethyl acrylate methyl chloride quaternary salts,

dimethylaminoethyl acrylate benzyl chloride quaternary salts, dimethylaminoethyl acrylate methyl sulfate quaternary salt, dimethylaminoethyl methacrylate methyl sulfate quaternary salt, dimethylaminoethyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl acrylamide methyl sulfate quaternary salts, dimethylaminopropyl methacrylamide methyl sulfate quaternary salts, diallyldimethyl ammonium chloride, N-vinyl formamide, dimethylamino ethyl methacrylate acid salts (including, but not limited to, sulfuric acid and hydrochloride acid salts), dimethylaminoethyl methacrylate methyl chloride quaternary salt, dimethylaminoethyl methacrylate benzyl chloride quaternary salt, methacrylamidopropyl trimethyl ammonium chloride, acrylamidopropyl trimethyl ammonium chloride, methylene bis acrylamide, triallylamine, acid salts of triallylamine, ethylene glycol dimethacrylate, hydroxymethylacrylate, hydroxyethylacrylate, hydroxypropylacrylate, hydroxypropylmethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethylacrylate, polyethylene glycol dimethacrylate, glycidyl methacrylate, acrylamidomethylpropane sulfonic acid and the sodium salt thereof, vinyl alcohol, vinyl acetate, and N-vinylpyrrolidone;

with the proviso that Q and W cannot both be the same;

wherein a is from about 0.001 to about 10.0 mole percent;

wherein j is from about 0 to about 99.999 mole percent;

wherein t is from about 0 to about 99.999 mole percent; and

wherein $a + j + t = 100$;

(2) $G_a Q_v W_f S_c$

wherein G is as previously defined;

wherein Q is as previously defined;

wherein W is as previously defined, with the proviso that Q and W

cannot both be the same;

wherein S is selected from the group consisting of sulfomethylacrylamide and sulfoethylacrylamide;

wherein a is from about 0.001 to about 10.00 mole percent;

5 wherein v is from about 0 to about 97.999 mole percent;

wherein f is from about 1 to about 97.999 mole percent;

wherein c is from about 1 to about 40 mole percent; and

wherein $a + v + f + c = 100$;

such that a desired concentration of said tagged treatment polymer is

10 present in said water;

b) using a fluorometer to detect the fluorescent signals of said inert tracer and said tagged treatment polymer;

c) converting the fluorescent signals of said inert tracer and said tagged treatment polymer to the concentration of said inert tracer and said tagged treatment polymer; and

15

d) adjusting the concentration of said tagged treatment polymer according to what the desired concentration is for said tagged treatment polymer in said industrial water system.

37. The method of Claim 36 wherein Q is acrylic acid and W is acrylamide.

20 38. The method of Claim 36 wherein Q is acrylamide, W is acrylic acid and S is N-sulfomethyl acrylamide.

39. The method of Claim 36 wherein Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.

40. The method of Claim 36 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid, W is
acrylamide and S is N-sulfomethylacrylamide.
41. The method of Claim 36 wherein G is
5 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-1',2'-benzimidazole, Q is acrylic acid, W
is acrylamide and S is N-sulfomethylacrylamide.
42. The method of Claim 36 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole, Q is acrylic acid and W is
acrylamidomethylpropane sulfonic acid.
- 10 43. The method of Claim 36 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-
1',2'-benzimidazole, Q is acrylic acid and W is acrylamidomethylpropane sulfonic acid.
44. The method of Claim 36 wherein G is
5-allyloxy-4'-carboxyl-1,8-naphthoylene-1',2' benzimidazole and Q is acrylic acid.
45. The method of Claim 36 wherein G is 6-vinylbenzyloxy-4'-carboxy-1,8-naphthoylene-
15 1',2'-benzimidazole, and Q is acrylic acid.